

Patent
Serial No. 10/524,982
Amendment in Reply to Final Office Action of August 6, 2008

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Previously presented) A method of breaking a substrate of brittle material, the method comprising acts of:

providing a substrate of a brittle material,

heating the substrate with a laser beam to create a heated spot on the substrate,

moving the laser beam and the substrate with respect to each other to create a line of heated spots on the substrate,

cooling the heated spots on the substrate by locally applying a cooling medium such that a micro-crack in the line of heated spots is propagated on the substrate, and

breaking the substrate along the line of the propagated micro-crack by applying a force on the substrate

wherein the cooling medium comprises an aqueous surfactant solution.

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2. (Previously presented) The method of breaking a substrate of brittle material according to claim 1, wherein the cooling medium further comprises air mixed with the aqueous surfactant solution.

3. (Previously presented) The method of breaking a substrate of brittle material according to claim 1, wherein the concentration of the surfactant is in the range of 0.01 to 1% of weight.

4. (Previously presented) The method of breaking a substrate of brittle material according to claim 1, wherein the aqueous surfactant solution comprises a cationic surfactant.

5. (Previously presented) The method of breaking a substrate of brittle material according to claim 4, wherein the cationic surfactant comprises cetyl trimethyl ammonium bromide (CTAB).

6. (Previously presented) The method of breaking a substrate of brittle material according to claim 1, wherein the aqueous surfactant solution comprises a nonionic surfactant.

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7. (Previously presented) The method of breaking a substrate of brittle material according to claim 6, wherein the nonionic surfactant comprises octadecyl deca(ethylenoxide) hydroxide.

8. (Previously presented) The method of breaking a substrate of brittle material according to claim 1, wherein the aqueous surfactant solution comprises an anionic surfactant.

9. (Previously presented) The method of breaking a substrate of brittle material according to claim 8, wherein the anionic surfactant comprises dodecylbenzene sulfonic acid sodium salt.

10. (Previously presented) The method of breaking a substrate of brittle material according to claim 1, wherein the brittle material comprises one or more of glass, crystalline silica and ceramics.

11. (Previously presented) A method of breaking a substrate of brittle material, the method comprising acts of:

providing a substrate of a brittle material,
heating the substrate with a laser beam to create a heated spot on the substrate,

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moving the laser beam and the substrate with respect to each other to create a line of heated spots on the substrate,

cooling the heated spots on the substrate by locally applying an aqueous surfactant solution such that a micro-crack in the line of heated spots is propagated on the substrate and the aqueous surfactant solution enters the micro-crack, and

breaking the substrate along the line of the propagated micro-crack by applying a force on the substrate, wherein the aqueous surfactant solution enters the micro-crack prior to the breaking act.

12. (Previously presented) The method of breaking a substrate of brittle material according to claim 11, wherein the aqueous surfactant solution is selected to bond to broken substrate bonds in the micro-crack.

13. (Previously presented) The method of breaking a substrate of brittle material according to claim 11, wherein the aqueous surfactant solution further comprises air mixed with the aqueous surfactant solution.

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14. (Previously presented) The method of breaking a substrate of brittle material according to claim 11, wherein the concentration of the aqueous surfactant solution is in the range of 0.01 to 1% of weight.

15. (Previously presented) The method of breaking a substrate of brittle material according to claim 11, wherein the aqueous surfactant solution comprises a cationic surfactant.

16. (Previously presented) The method of breaking a substrate of brittle material according to claim 15, wherein the cationic surfactant comprises cetyl trimethyl ammonium bromide (CTAB).

17. (Previously presented) The method of breaking a substrate of brittle material according to claim 11, wherein the aqueous surfactant solution comprises a nonionic surfactant.

18. (Previously presented) The method of breaking a substrate of brittle material according to claim 17, wherein the nonionic surfactant comprises octadecyl deca(ethylenoxide) hydroxide.

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19. (Previously presented) The method of breaking a substrate of brittle material according to claim 11, wherein the aqueous surfactant solution comprises an anionic surfactant.

20. (Previously presented) The method of breaking a substrate of brittle material according to claim 19, wherein the anionic surfactant comprises dodecylbenzene sulfonic acid sodium salt.